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THE OPTIMUM TIME FOR TREATING RADIATION INJURY WOUNDS

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THE OPTIMUM TIME FOR TREATING RADIATION INJURY WOUNDS

[Following is the translation of an article by Dr Endre Kotai and Dr Eva Csanyi in Honvedorvos (Army Doctor), Vol. XIII, No 1, Budapest, 1961, pages 80-84.]

In the last two decades atomic physics have progressed very fast. More and more peacetime and military applications of atomic energy are being discovered. Hence we will see more and more radiation injuries. In some injuries, a mechanical wound forms in addition to the radiation damage. Problems of radiation injuries were treated in previous communication. Our experiments and Dr Egri's observations revealed an extraordinary phenomenon: if wounds are treated very soon after the injury (within 1-2 hours) we find more complications in the course of healing than when the wounds are treated later, in the third or fourth hour after the injury. The present work is a check of this obeservation.

Experimental part

We used 20-20 male white rats in the experimental groups. The rats weighed ca. 200 g. each. We wounded the animals with trepan on their back chest wall, near the spine below the shoulder-blade. The wounds were round, of 1 cm diameter and penetrated into the soft tissue, going through the skin and the connecting tissues and reaching the muscles. The animals were under ether anesthesia.

Just before the wounding, the animals ware subjected to radiation injury. Their whole body was irradiated from an X-ray apparatus. The animals were put into wooden boxes (with partitions) and could not change their positions. The irradiation data: 170 KV (150 table KV); 10 mA; 1 m focal length, 0.5 Cu-dilter, air-dose, 60 min. The animals received a whole-body irradiations of 400 roentgen. This is equivalent to 20/DL/30 radiation sensitivity. (Thanks should go to Dr Erno Sarmay for his theoretical and technical help with the irradiation.

Several control groups were used which received no irradiation, only wounds and wound treatment. For the determination of

Table 1.

Groups	No.	Dose	Wounded	First aid given	Number of animals	Healing time	Died		Complications		Total Complications	
							No.	%	No.	%	No.	%
Experimental Groups	1.	400 r	Yes	1 hr. after injury	39	13	7	18	5	13	12	31
	2.	400 r	Yes	2 hours after	39	12	15	38	11	28	26	66
	3.	400 r	Yes	3 hours after	38	15	7	18	8	20	15	38
	4.	400 r	Yes	4 hours after	19	17	3	16	4	21	7	37
	5.	400 r	Yes	5 hours after	19	17	8	42	5	26	13	68
	6.	400 r	yes	6 hours after	19	16	10	52	6	31	16	83
	7.	400 r	Yes	7 hours after	18	15	7	39	6	33	13	72
	8.	400 r	Yes	8 hours after	18	17	8	44	9	50	17	94
Control Groups	9.	—	Yes	1 hour after	20	7	—	—	2	10	2	10
	10.	—	Yes	2 hours after	19	8	—	—	3	16	3	16
	11.	—	Yes	3 hours after	19	8	—	—	5	26	5	26
	12.	—	Yes	4 hours after	20	9	1	5	6	30	7	35
	13.	—	Yes	6 hours after	20	9	1	5	9	45	10	50
	14.	—	Yes	12 hours after	19	15	1	5	7	37	8	42
	15.	—	Yes	18 hours after	18	15	—	—	6	35	6	35
	16.	—	Yes	24 hours after	18	16	1	5	7	37	8	42
	17.	—	Yes	—	20	13	—	—	—	—	—	—
	18.	400 r	yes	—	20	21	6	30	5	25	11	55
	19.	400 r	—	—	20	—	4	20	—	—	4	20

ray-sensitivity, there was a group that received irradiation only. Two other groups were used, neither of which received wound treatment. One of them was irradiated, the other was not.

The experimental and control groups were given first aid (excisio, sutura) in 1-2-3-4-6-12-18-24 hrs. After that the animals were checked for 30 days for healing complications and death rate.

The experiments where the irradiated animals got first aid within 1-2-3 hours were made with 40 animals for higher accuracy.

Results are shown in Table 1.

Results

It can be seen that non-irradiated animals treated within three hours did not expire. The number of local complications grow up to the sixth hour after that they remain at the same level. This, of course, confirms Friedrich's rule: the sooner we treat a wound, the fewer complications can be expected. It can also be seen that healing came faster when first aid was given than when the wound healed in a secondary manner.

The death rate of irradiated animals that were treated within six hours is not higher than in general. It doubled, however, for animals that were untreated for more than six hours. Local complications are more numerous in every group than in its non-irradiated control group. The number of the total complications in the individual irradiated groups is generally twice the number of complications in their control groups. The curves of complications have similar shapes, but that of the irradiated group is of higher level.

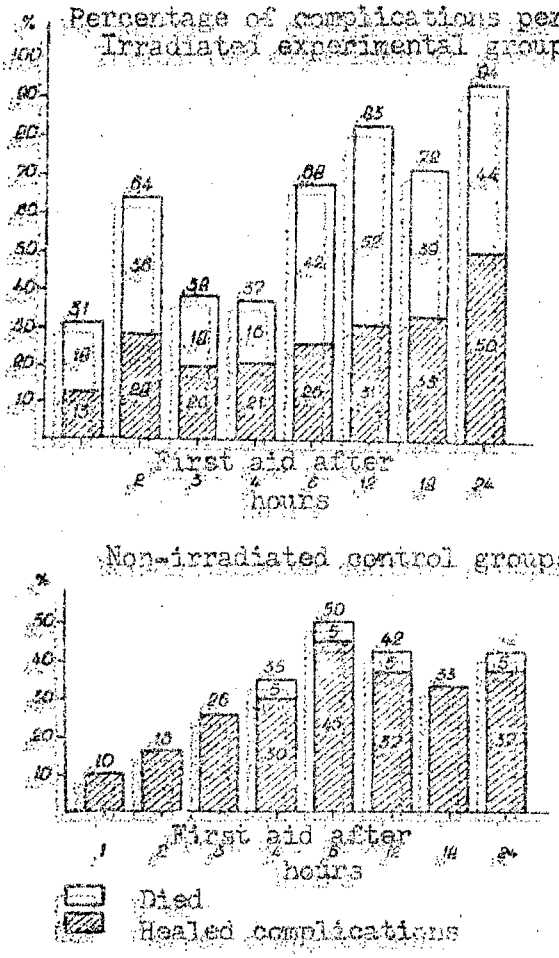
There is one important difference between the two curves. Those irradiated animals that were treated two hours after wounding developed more complications than those treated either one or three hours after wounding. In fact, the number of complications almost reaches that of the six hour group. If we compare the results of the groups treated within 1-2-3 hours, the number of complications shows a significant difference: in the one and two hour groups, $P < 0.01$; in the two and three hour groups, $0.02 < P < 0.01$. Comparing the irradiated and control group of the rats treated within two hours: $P < 0.01$. The differences are not significant in any other groups. (Thanks should go for help in the calculations to Dr Ireneusz Juvancz.) Hence these experiments confirm the results of our previous work and Dr Egri's observations.

Discussion

The experiment showed that treatment of wounds must come within six hours in radiation injury cases, too. This conforms to Friedrich's rule. But in our experiments, animals treated in the second hour after the injury have a higher complication rate than animals treated later. In other experiments, the first two hours

gave a higher rate.

It is difficult to explain this anomaly. Reproduction of all experiments and individual analysis of the animals is hardly feasible. It appears that the early effect of the rays and the shock of the wounding and of the operation combine and cumulate. The body is able to mobilize its defensive apparatus only after a certain time-lapse. In our experiments, this takes 3-4 hours. The results remain good until the sixth hour after wounding, after which infection sets in and worsens the condition.



Since these experiments were carried out on small animals in which shock effect is not similar to that of man, it is not clear whether these results can be carried over to man without modification. We do not know whether early anti-shock treatment could have modified the results.

Conclusions

Wounds of irradiation have to be treated three to six hours after the injury. First aid before and after this period causes too much complications, probably due to shock (in the 0-3 hour period) and infection (in the after 6 hour period).

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